## **Roanoke County 2008 Community Carbon Footprint**

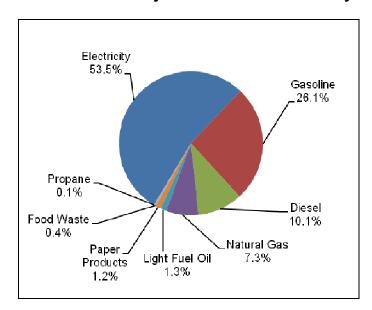
This is the second year of tracking greenhouse gas emissions and the total carbon footprint for Roanoke County in 2008 was calculated to be just over 1.8 million tons, a decrease of slightly less than 1% from the 1.82 million tons of the baseline year 2007. It should be noted that the 2007 baseline total has been amended downward slightly from 1.86 million to 1.82 million tons due to errors in the Natural Gas usage data and a reduction in the carbon emission coefficient for electricity based on AEP measurements. The GHGE figures are determined by entering energy consumption information supplied by American Electric Power (AEP), Roanoke Gas, VDOT, (total vehicle miles travelled in the County), and other available pertinent fuel and energy data into ICLEI CACP software.

The composition of Roanoke County's carbon footprint when viewed by energy source is shown in Table 1 and Figure 1.

Table 1 – Roanoke County 2008 Carbon Emissions and Energy by Source

| Source         | Equiv CO <sub>2</sub><br>Tons | Equiv CO <sub>2</sub> | Energy<br>MBtu |
|----------------|-------------------------------|-----------------------|----------------|
| Electricity    | 964,706                       | 53.5%                 | 3,790,457,041  |
| Gasoline       | 471,799                       | 26.2%                 | 5,525,177,001  |
| Diesel         | 182,105                       | 10.1%                 | 2,099,179,455  |
| Natural Gas    | 131,340                       | 7.3%                  | 2,125,856,300  |
| Light Fuel Oil | 24,250                        | 1.3%                  | 293,359,406    |
| Paper Products | 21,477                        | 1.2%                  |                |
| Food Waste     | 6,858                         | 0.4%                  |                |
| Propane        | 2,113                         | 0.1%                  | 29,187,250     |
| Plant Debris   | -754                          | 0.0%                  |                |
| Wood/Textiles  | -452                          | 0.0%                  |                |
| Totals         | 1,803,442                     | 100.0%                | 13,863,216,453 |

Figure 1 – Roanoke County 2008 Carbon Emissions by Source



It can be seen that electricity plays a disproportionately large role in the local carbon footprint because:

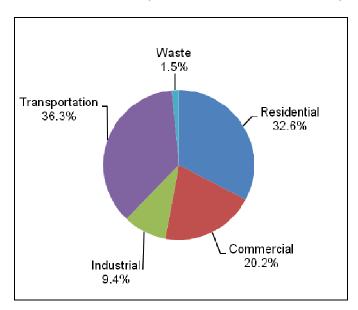
- Over 88% of Roanoke County's electric power is derived from burning coal.
- Coal emits about twice as much carbon dioxide per unit of energy as natural gas.
- Coal emits about 50% more carbon dioxide than gasoline per unit of energy.

When viewed by contributing sector in table 2 and figure 2, Transportation fuel usage is the largest contributor of  $CO_2$  by a small margin of ~4% over Residential energy consumption which is followed by commercial usage and industrial emissions a distant  $4^{th}$ . Methane gas resulting from decomposition of organic material in landfills contributes the least in this analysis. It is very revealing to note that while the Residential sector contributes nearly as much  $CO_2$  as Transportation, but uses less than  $\frac{1}{2}$  the energy of the transportation sector.

Table 2 – Roanoke County 2008 Carbon Emissions and Energy by Sector

| Sector         | Equivalent CO <sub>2</sub> Tons | Equiv CO <sub>2</sub> | Energy MBtu    |
|----------------|---------------------------------|-----------------------|----------------|
| Transportation | 653,904                         | 36.3                  | 7,624,356,456  |
| Residential    | 588,688                         | 32.6                  | 3,505,152,412  |
| Commercial     | 363,527                         | 20.2                  | 1,826,554,997  |
| Industrial     | 170,194                         | 9.4                   | 907,152,588    |
| Waste          | 27,129                          | 1.5                   | na             |
| Totals         | 1,803,442                       | 100                   | 13,863,216,453 |

Figure 2 – Roanoke County 2008 Carbon Emissions by Sector



## **Roanoke County government portion**

The County government's carbon footprint was 14,466 tons CO<sub>2</sub>, less than one percent of the total for the whole community, as shown in Figure 3. This is virtually unchanged from the baseline year.

Government 0.8%

Community 99.2%

Figure 3: Comparison of Community and Municipal Government CO<sub>2</sub> Emissions (2008)

As detailed in the table 4, the largest portion of County government emissions comes from energy used to heat and cool buildings, followed closely by fleet emissions. This is a reversal of 2007 when a slightly greater proportion of emissions was generated by the fleet. Similar to the community carbon footprint, transportation consumed almost twice as much energy in Btu's as buildings but the single greatest source of GHG emissions was the County's buildings, again because the high percentage of coal used to generate our electricity. Further insight can be gained by looking at the sources of fuel used to operate County buildings and vehicles as detailed in Table 5.

Table 4 - Roanoke County Government Greenhouse Gas Emissions in 2008 by Sector

| Sector        | Equivalent CO <sub>2</sub> Tons | Equiv CO <sub>2</sub> | Energy<br>MBtu | Cost<br>(\$) |
|---------------|---------------------------------|-----------------------|----------------|--------------|
| Buildings     | 7,245                           | 50.1                  | 39,295,089     | 676,056      |
| Vehicle Fleet | 6,499                           | 44.9                  | 75,795,104     | 1,182,197    |
| Streetlights  | 722                             | 5.0                   | 2,835,222      | 104,890      |
| Totals        | 14,466                          | 100                   | 117,925,415    | 1,963,143    |

Table 5 – Roanoke County Government Greenhouse Gas Emissions in 2008 by Source

|             | Equiv CO <sub>2</sub> | Equiv CO <sub>2</sub> | Energy     | Cost    |
|-------------|-----------------------|-----------------------|------------|---------|
| Source      | Tons                  | %                     | MBtu       | (\$)    |
| Electricity | 7,067                 | 48.9%                 | 27,767,720 | 577,898 |
| Gasoline    | 4,143                 | 28.6%                 | 48,661,745 | 731,047 |
| Diesel      | 2,356                 | 16.3%                 | 27,133,359 | 451,150 |
| Natural Gas | 825                   | 5.7%                  | 13,345,813 | 171,050 |
| Propane     | 66                    | 0.5%                  | 911,810    | 30,498  |

| Light Fuel Oil       | 9      | 0.1%   | 104,968     | 1,500     |
|----------------------|--------|--------|-------------|-----------|
| Totals               | 14,466 | 100.0% | 117,925,415 | 1,963,143 |
| % of Community Total | 0.80%  |        |             |           |

## Conclusion

As can be seen from the table 6 there have been some minor year-to-year changes in carbon emissions for the County as a whole. Of most importance is the fact that GHG emissions have gone down from 2007 by 0.8%. This report does not attempt to scientifically verify the cause of that change but it may be inferred that the change is likely a byproduct of the economic recession. While the 2 major contributing sectors, residential and transportation, both decreased by 1.5%, industrial increased by 2.46% and this may be a result of increased production or other factors.

Table 6 - Comparison of Greenhouse Gas Emissions by Sector and Year

| Equivalent CO <sub>2</sub> Tons | 2007      | 2008      | % Change |
|---------------------------------|-----------|-----------|----------|
| Transportation                  | 663,960   | 653,904   | -1.5%    |
| Residential                     | 597,468   | 588,688   | -1.5%    |
| Commercial                      | 364,327   | 363,527   | -0.2%    |
| Industrial                      | 166,097   | 170,194   | +2.5%    |
| Waste                           | 27,152    | 27,129    | -0.1%    |
| Totals                          | 1,819,004 | 1,803,442 | -0.9%    |

Another important way of comparing the 2008 GHGE to the baseline year of 2007 is by the fuel or energy source used in the community and the quantity of GHGE each produced. Table 7 illustrates the relative change in the four major sources.

Table 7 - Comparison of Greenhouse Gas Emissions by Source and Year

| Equivalent CO <sub>2</sub> Tons | 2007      | 2008      | % Change |
|---------------------------------|-----------|-----------|----------|
| Electricity                     | 975,906   | 964,706   | -1.1%    |
| Gasoline                        | 473,054   | 471,799   | -0.3%    |
| Diesel                          | 190,906   | 182,105   | -4.6%    |
| Natural Gas                     | 125,623   | 131,340   | +4.6%    |
| All Others                      | 53,514    | 53,492    | -0.04%   |
| Totals                          | 1,819,004 | 1,803,442 | -0.9%    |

It can be seen that the  $CO_2$  emissions from electricity are down somewhat from the baseline and here again this may be attributable to the recession and higher electricity rates. Emissions from gasoline are down slightly and diesel somewhat more at -4.6% and this could be attributed to the reduced shipping volume as a result to the economic downturn. Increased emissions from natural gas in the period would suggest increased heating load which matches the colder 2008 winter with 3842 Heating Degree Days (HDD) compared to 3666 in 2007.

All things considered, the slight decrease in  $CO_2$  emissions is a positive result and positions Roanoke County well for achieving its stated target of 3% per year reduction in  $CO_2$  from 2010 to 2020. Greenhouse gas emissions totals for 2009 will not be available until sometime during the summer of 2010 but it is the hope that community conservation efforts coupled with a weak economy will continue the downward trend in  $CO_2$  emissions.